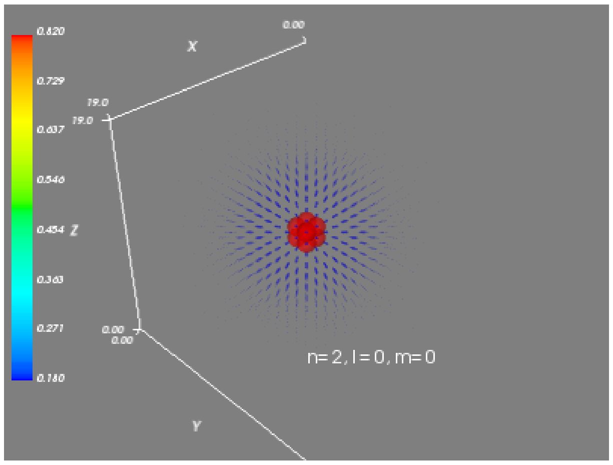
N =2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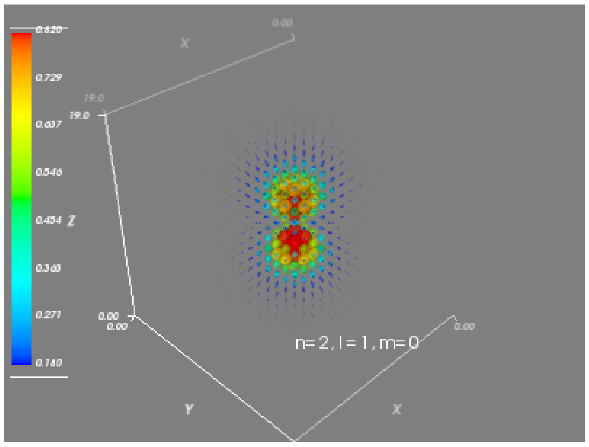
0.729
0.637
0.546
0.454
0.363
0.271
0.180
X
Y
Z
19.0
0.00
n= 2, l = 0, m= 0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X
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Z
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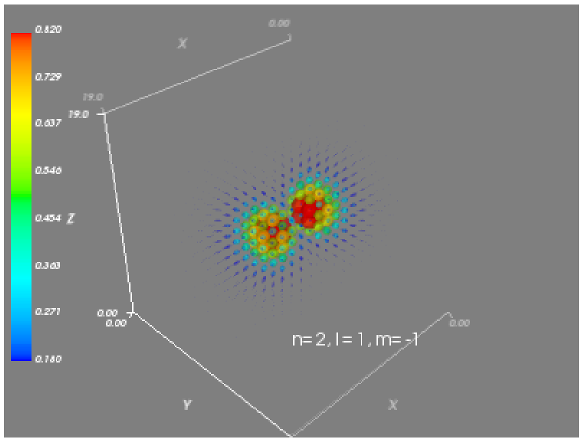
n= 2, l = 1, m= 0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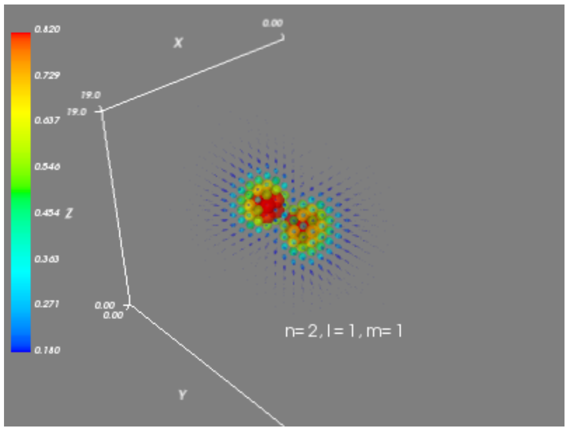
n= 2, l = 1, m= -1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0.180
X
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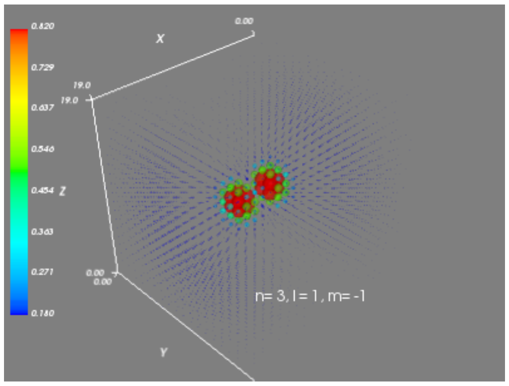
n= 2, l = 1, m= 1

N = 3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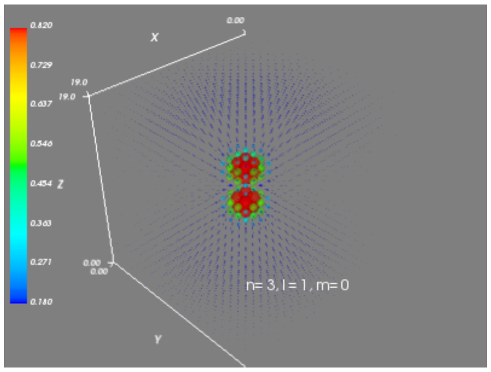
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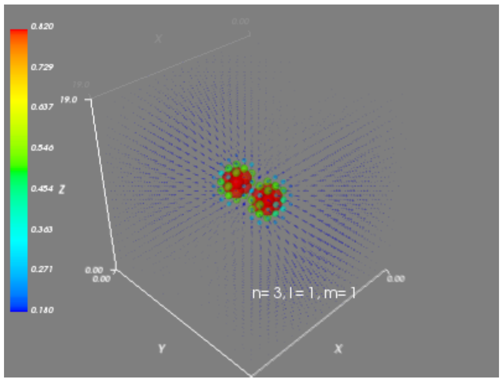
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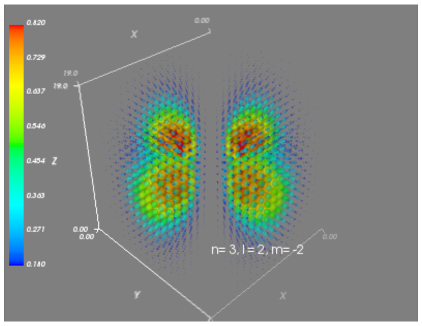
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Z
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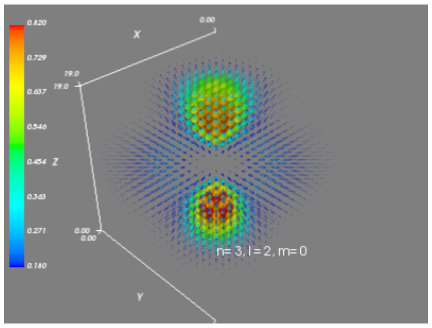
0.00
n= 3, l= 2, m= -2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Z
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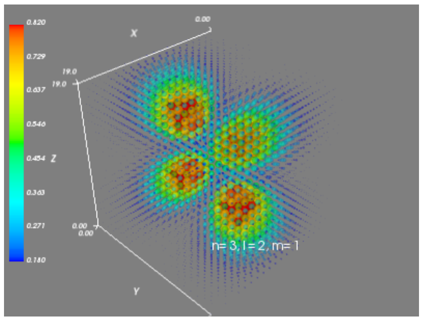
n= 3, l= 2, m= 0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X
Y
Z
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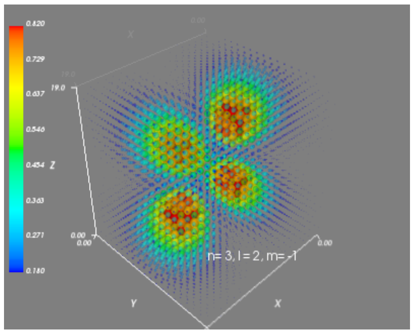
0.00
n= 3, l= 2, m= 1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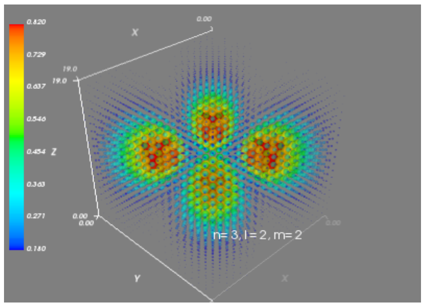
n= 3, l= 2, m= -1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0.637
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0.180
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Z
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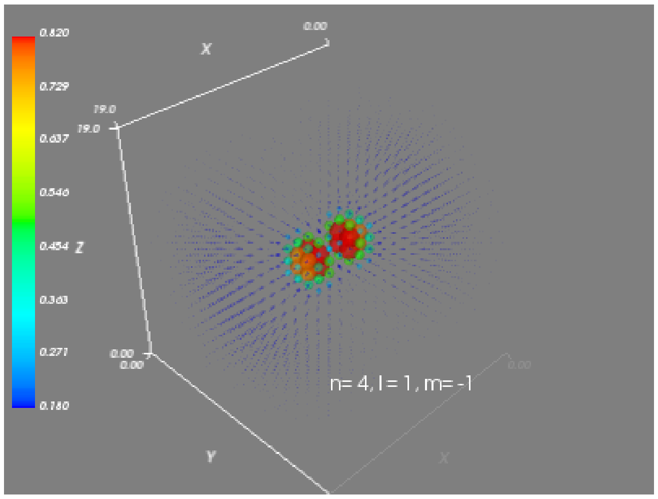
n= 3, l= 2, m= 2

N = 4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0.363
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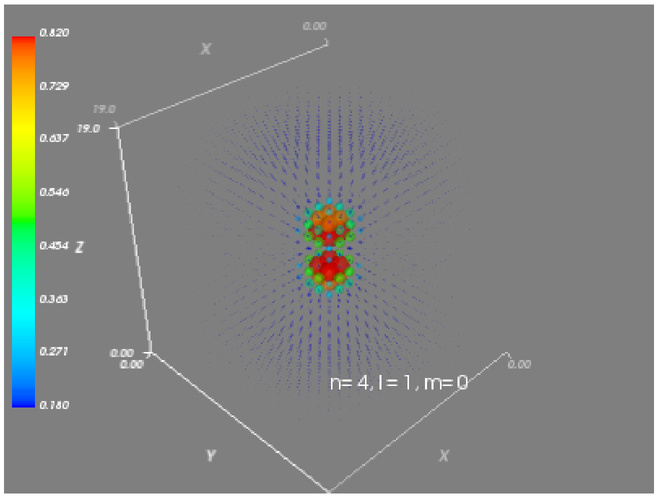
Z
19.0
0.00
n= 4, l= 1, m= -1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0.180
X
Y
Z
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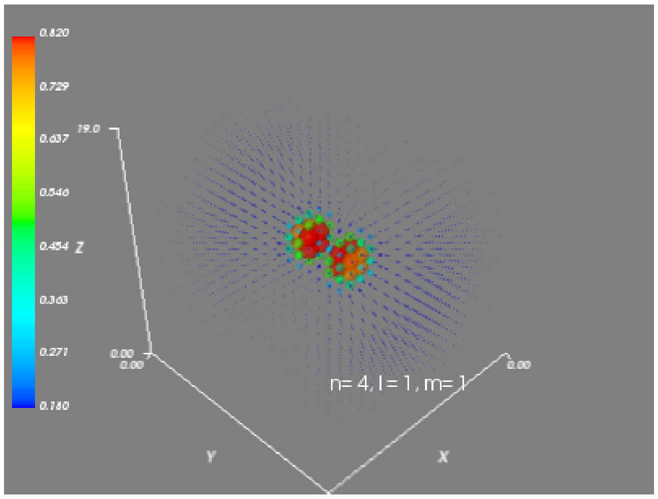
n= 4, l= 1, m= 0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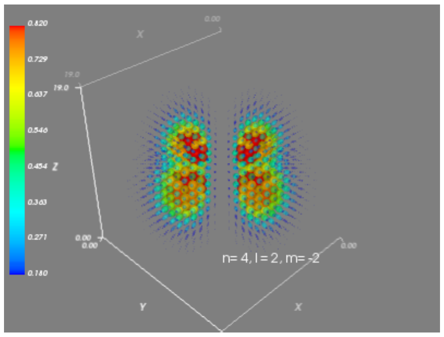
0.454
0.363
0.271
0.180
X
Y
Z
19.0
0.00
n= 4, l= 1, m= 1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0.637
0.546
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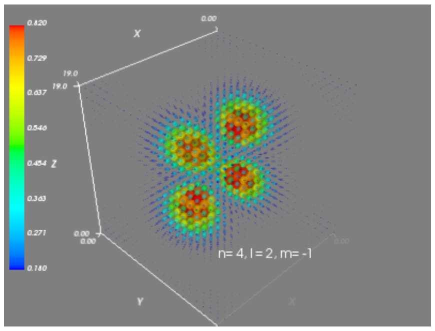
0.180
X
Y
Z
19.0
0.00
n= 4, l= 2, m= -2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0.637
0.546
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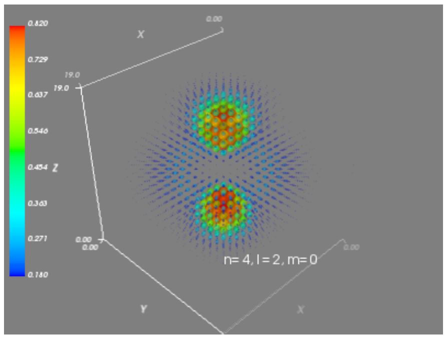
0.180
X
Y
Z
19.0
0.00
n= 4, l= 2, m= -1


0.820
0.729
0.637
0.546
0.454
0.363
0.271
0.180
X
Y
Z
19.0
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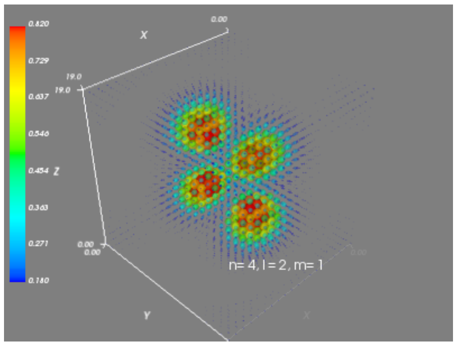
n= 4, l= 2, m= 0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0.363
0.271
0.180
X
Y
Z
19.0
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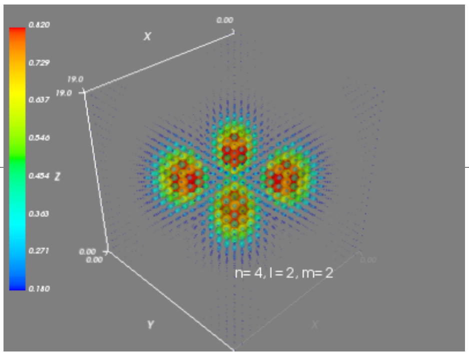
n= 4, l= 2, m= 1


0.820
0.729
0.637
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0.454
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X
Y
Z
19.0
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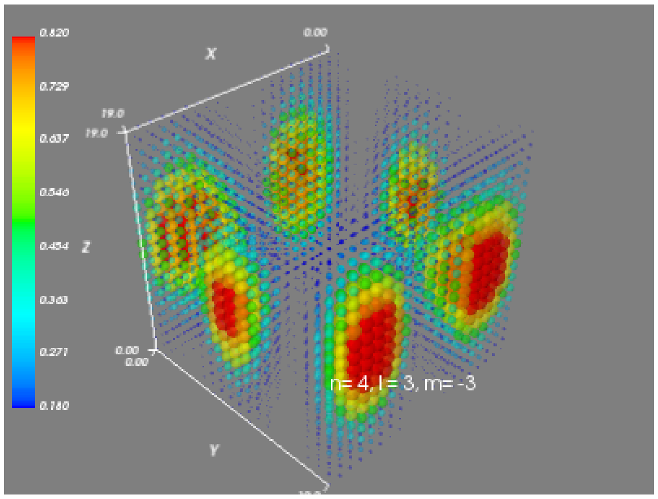
n= 4, l= 2, m= 2

N = 4


0.820
0.729
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0.454
0.363
0.271
0.180
X
Y
Z
0.00
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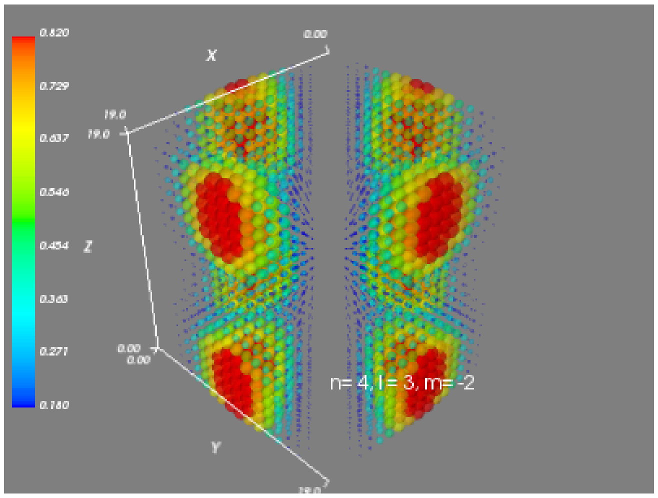
n= 4, l= 3, m= -3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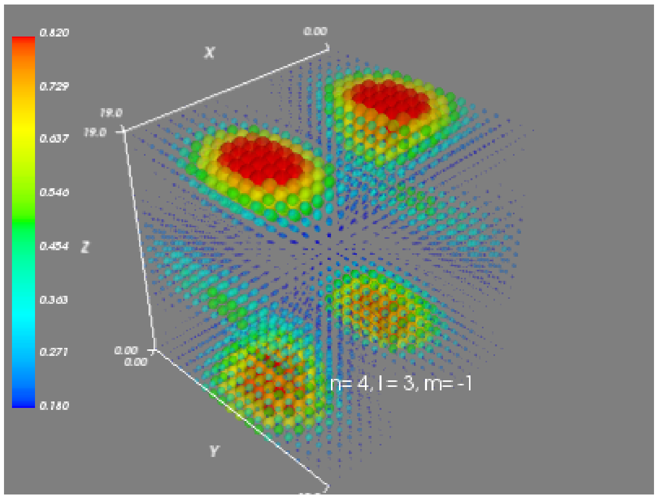
X
Y
Z
0.00
19.0
n= 4, l= 3, m= -2


0.820
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X
Y
Z
0.00
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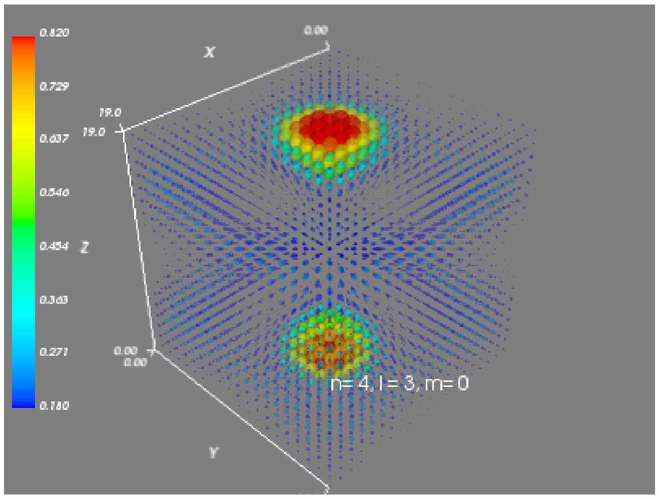
n= 4, l= 3, m= -1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X
Y
Z
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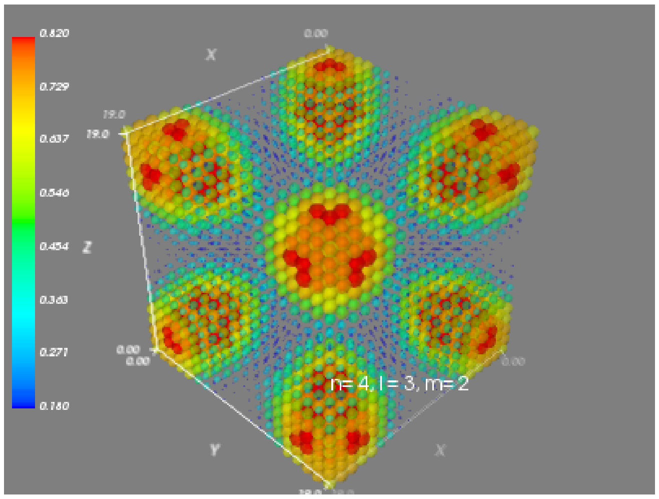
n= 4, l= 3, m= 0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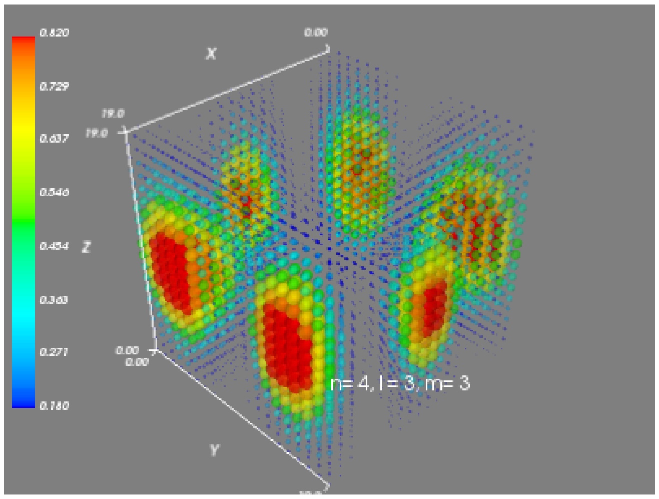
0.180
X
Y
Z
0.00
19.0
n= 4, l= 3, m= 2


0.820
0.729
0.637
0.546
0.454
0.363
0.271
0.180
X
Y
Z
0.00
19.0
n= 4, l= 3, m= 3

Laguerre and Legendre functions were generated algorithmically for large values as it was tedious to compute by hand and computers exist.

```
Code:
import numpy as np
import scipy.constants as c
from sympy import diff, factorial, simplify, symbols, E
import math


def fact(n):
    """
    factorial of n
    :param n: int
    :return: int
    """
    if type(n) != int:
        n = int(n)

    if n == 1:
        return 1

    else:
        acc = 1
        for x in range(1,n+1):
            acc = acc * x

    return int(acc)


# Q4

def assoc_legendre(m,l):
    def f00(a):
        x = symbols('x')
        #x, l, m = symbols('x l m')
        if m == 0 and l == 0:
            return 1
        else:
            diff_l =  diff((x**2 - 1)**l,x,l)
            #print(type(l))
            fact_l = factorial(int(l))
            fact_l = 1.0/((fact_l) * (2**l))
            lp = fact_l * diff_l

            asslegen = ((1-x**2)**((abs(m))/2)) * (diff(lp,x,abs(m)))
            print asslegen
            return asslegen.evalf(subs={x:math.cos(a)})
            #return diff_l
    return f00



def assoc_laguerre(p,qmp):
    def f(a):
        x = symbols('x')
    if p == 0 and qmp == 0:
        return 1
    else:
        y = (E**(-x))* (x**(qmp+p))
        eel = (E**(x))
        diff_l = eel * y.diff(x, qmp+p)

        ass_l = ((-1)**p)*diff_l.diff(x,p)
        #print(ass_l)
        return int(round(ass_l.evalf(subs={x:a}),0))
return f
```